

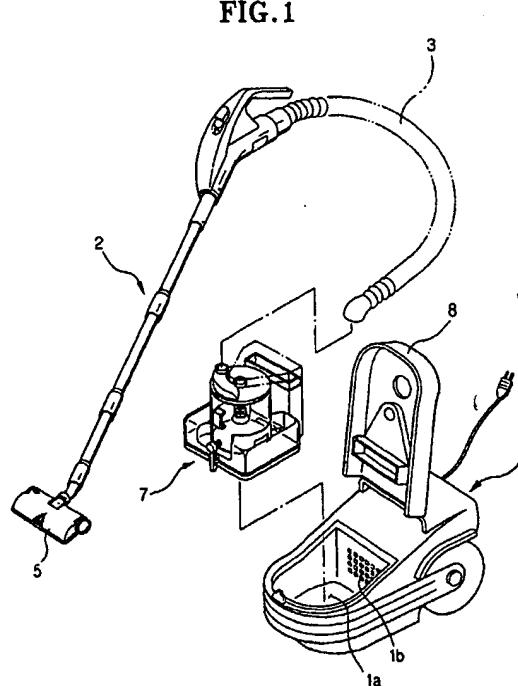
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(54) Abstract Title  
Cyclone vacuum cleaner with overlapping particle receptacle

(57) A vacuum cleaner includes a cyclonic dust separator 7 comprising a generally cylindrical hollow cyclone body 11, a tangential air inlet port 17a, an axially located clean air exhaust port 17b, and a circumferentially located contaminant outlet 11c associated with a cyclone lower end wall, and an entrained particle receptacle 13 overlapping a lower portion of the cyclone body 11 and also possibly the circumferentially located contaminant outlet 13. Also disclosed is the above, further featuring a dust collecting chamber 1a, suction motor housing chamber, suction brush 5, a base member 15 pivotally coupled to the bottom of the entrained particle receptacle 13, a top cover 35 with air inlet and outlet, and a contaminant separating grille, depending from the clean air exhaust port 17b, having a plurality of fine holes. The base member 15 may be held in place by a releasable sprung catch mechanism 18.



GB 2 365 324 A

FIG.1

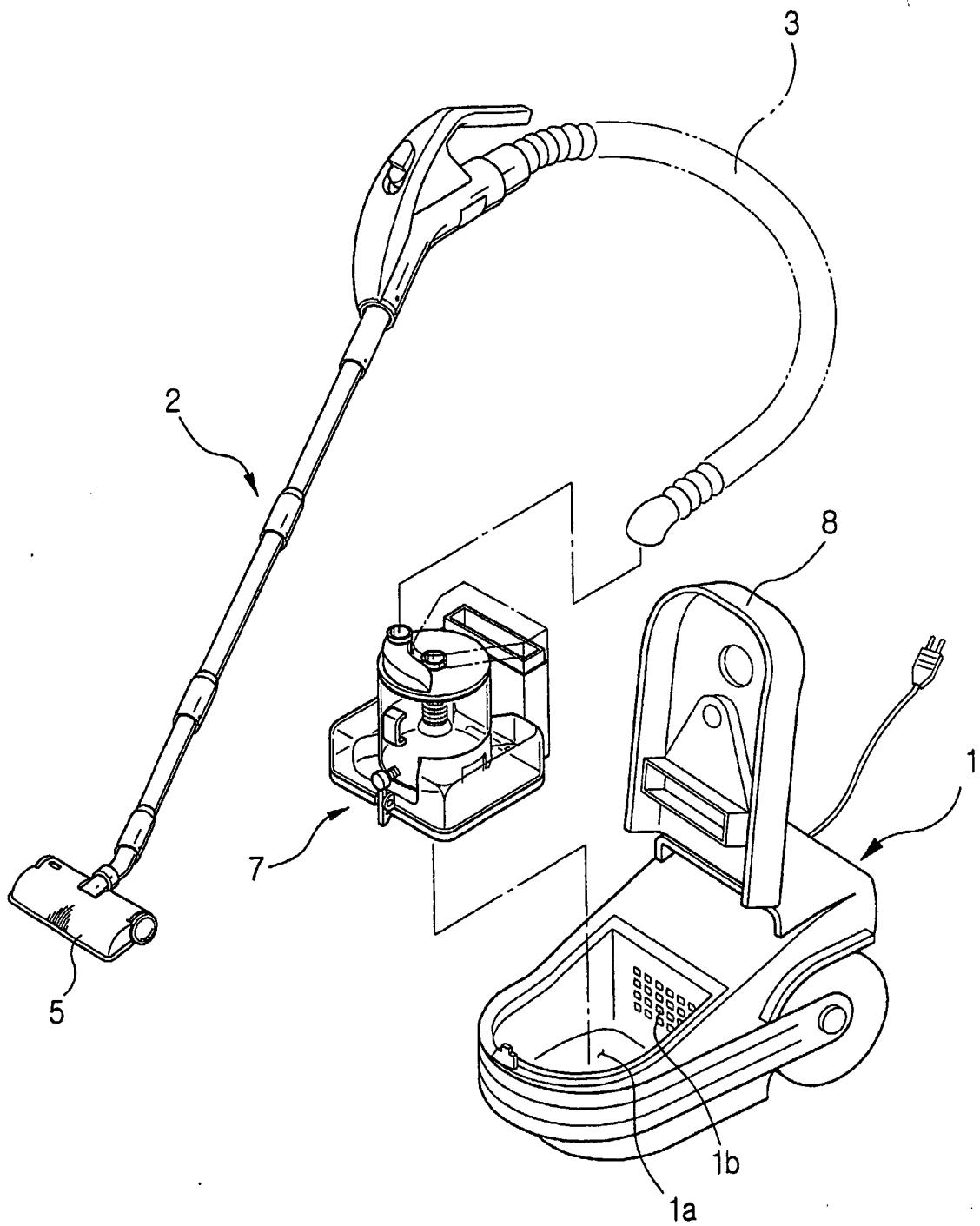
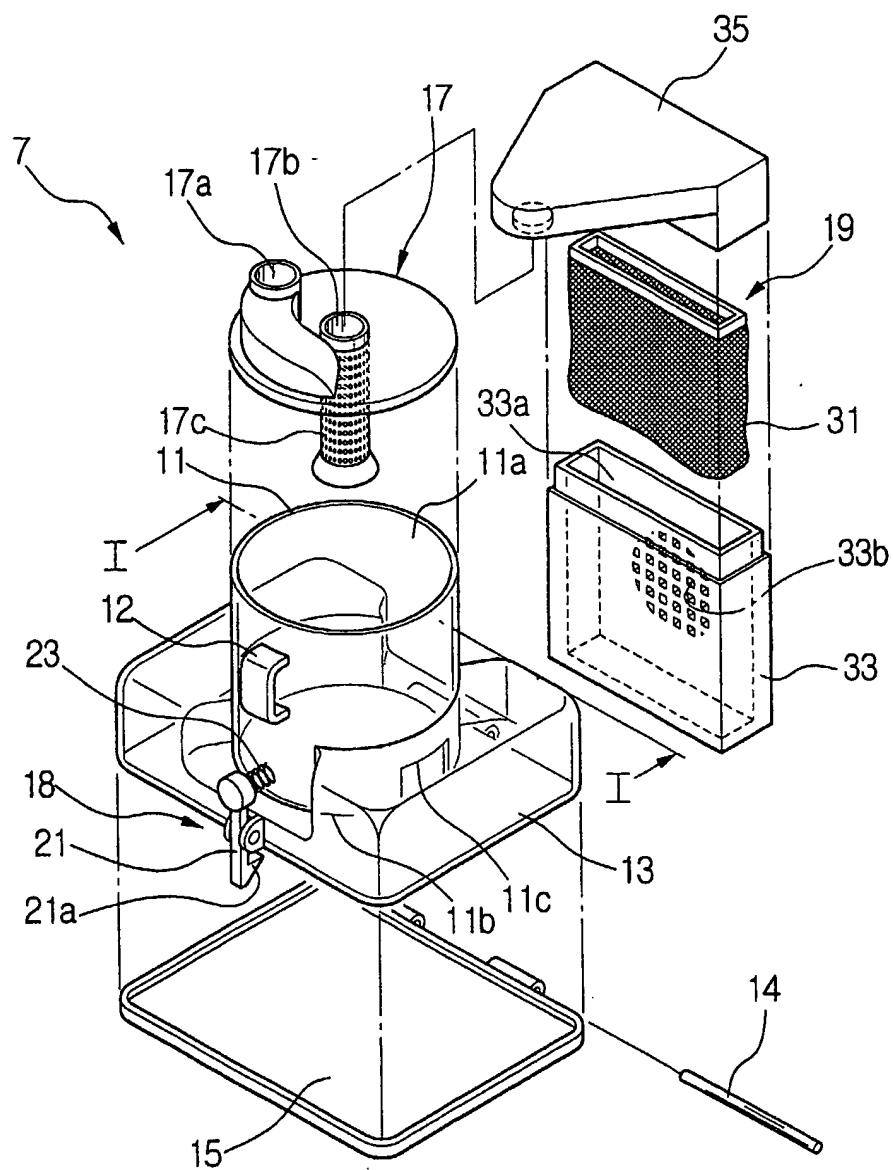


FIG.2



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FIG.3

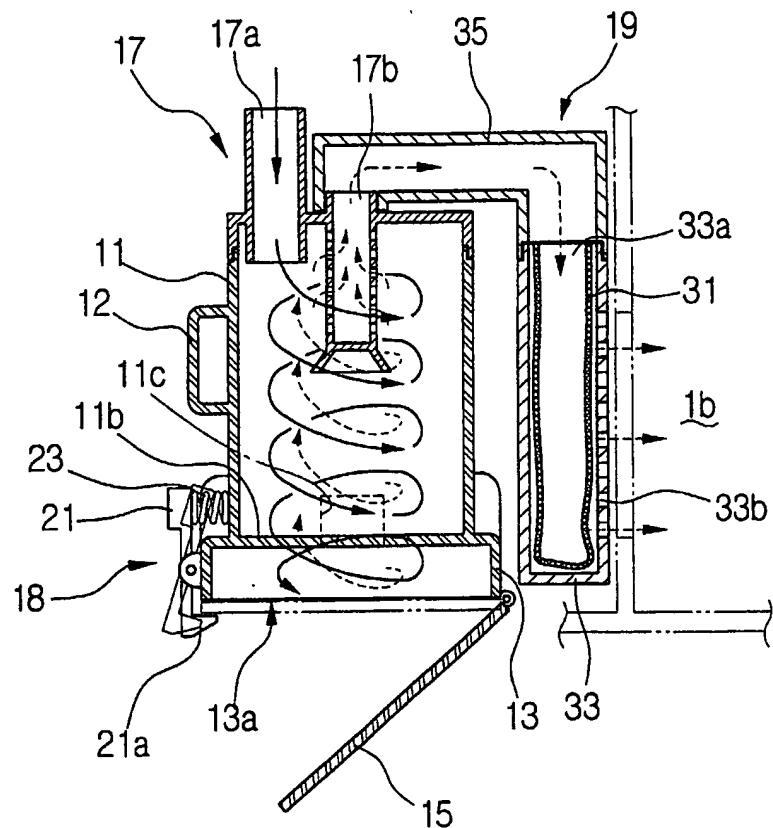
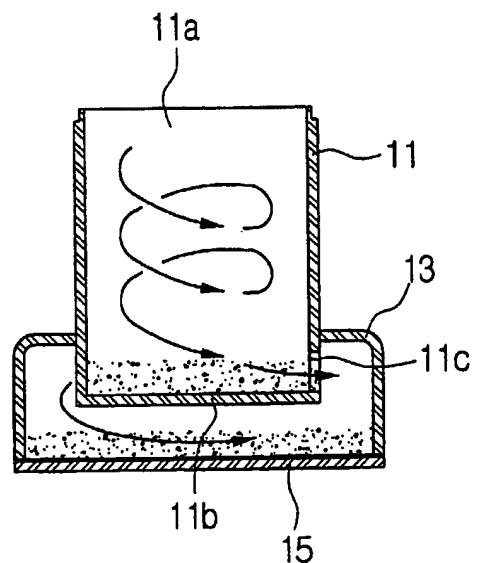


FIG.4



**VACUUM CLEANER HAVING CYCLONE TYPE DUST  
COLLECTING APPARATUS**

The present invention relates to a vacuum cleaner having cyclone type dust collecting apparatus that separates by centrifugal force contaminants from the air drawn into 5 the vacuum cleaner.

Generally, vacuum cleaners such as upright type, canister type cleaners or the like, have a suction head or brush that is connected to the body of the vacuum cleaner and moves along on the cleaning surface. The body of the cleaner includes a dust collecting chamber, in which a dust filter is detachably mounted, and a motor chamber, in which a motor for 10 generating the suction force is mounted. The suction force draws air and any dust or dirt on the cleaning surface into the cleaner body. The air is discharged from the cleaner after passing through the dust filter. The various contaminants in the air are filtered out by the dust filter, while the clean air is discharged to the environment.

A disadvantage of a structure in which contaminants are filtered and collected by an 15 expendable dust filter is that when the dust filter is clogged with contaminants, the filter has to be replaced and the user must manually remove the used, dirty filter and insert a new one, which is both inconvenient and unhygienic.

The present invention provides a vacuum cleaner having a cyclone type dust collecting apparatus capable of separating by centrifugal force and collecting dust or 20 contaminants from the air drawn in by a suction head.

In particular, according to a first aspect of the invention, a vacuum cleaner comprises a cleaner body, a suction brush, through which air and contaminants are drawn in, and a cyclone type dust collecting device. The cleaner body has a motor chamber and a dust collecting chamber in communication with the motor chamber. The dust collecting 25 device is mounted in the dust collecting chamber and separates the contaminants from the air by centrifugal force. The dust collecting device includes a hollow cylindrical cyclone body having an open top, a closed bottom, and a contaminant outlet. The open top allows air and contaminants into the cyclone body, where centrifugal separation takes place. The contaminants are then discharged from the cyclone body through the contaminant outlet. 30 The dust collecting device further includes a contaminant receptacle for collecting the contaminants discharged through the contaminant outlet, a base member hingedly connected to the contaminant receptacle, and a cover for covering the top of the cyclone body. The cover has an air inlet passage, through which air and contaminants drawn in through the

suction brush enter the cyclone body, an air outlet passage, through which the air is discharged from the cyclone body, and a contaminant separating grille. The grille extends downwardly from the air outlet passage into the cyclone body and has a plurality of holes.

The invention will now be described by way of example with reference to the 5 drawings in which:

Figure 1 is a perspective view of a vacuum cleaner in accordance with the invention, having cyclone type dust collecting apparatus;

Figure 2 is an exploded, perspective view of the dust collecting apparatus of Figure 1;

10 Figure 3 is a sectional view of the dust collecting apparatus of Figure 2 in an assembled state; and

Figure 4 is a cross-sectional view taken generally along the line I-I of Figure 2.

Referring to Figure 1, a vacuum cleaner includes a body 1, a suction head or brush 5 connected to the body 1 through a connecting tube 2 and a connecting hose 3, and a cyclone 15 dust collecting device 7.

The cleaner body 1 includes a dust collecting chamber 1a, in which the cyclone dust collecting device 7 is nested, and a motor chamber (not shown) in which a motor (not shown) is nested. The motor driving chamber and the dust collecting chamber 1a communicate with each other. The motor generates a strong suction force, which enables 20 the suction head 5 to draw in contaminants on the cleaning surface. The suction head 5 is connected via the connecting tube 2 and the connecting hose 3 to the dust collecting device 7, which is located in the dust collecting chamber 1a. Here, a cover 8 is attached to the cleaner body 1 to cover the cyclone dust collecting device 7, when the dust collecting device 7 is in the dust collecting chamber 1a. The cover 8 can be opened and closed.

25 The dust collecting device 7 separates by centrifugal force and collects contaminants from the air that is drawn into the vacuum cleaner through the suction head 5 and is detachably nested in the dust collecting chamber 1a. As shown in Figures 2, 3, and 4, the cyclone dust collecting device 7 includes a cyclone body 11, a contaminant receptacle 13, a base member 15, and a cover 17.

30 The cyclone body 11 is hollow and substantially cylindrical, with a predetermined inner diameter. It has an open top 11a, a closed bottom 11b, a handle 12 formed on the outer surface of the body 11, and a contaminant outlet 11c of a predetermined size formed on the lower portion of the cyclone body 11. Accordingly, contaminants in the air, drawn

into the upper portion of the cyclone body 11 are separated from the air by centrifugation and discharged into the contaminant receptacle 13 through the contaminant outlet 11c.

References herein to "top", "bottom", "upper" "lower" and so on are to be construed as relating to the orientation or position of components of the cleaner when the cleaner is in 5 its normal operating orientation.

The contaminant receptacle 13, which serves as a collection place for the contaminants that have been discharged through the contaminant outlet 11c, covers the bottom 11b of the cyclone body 11 and partly surrounds the outer circumference of the cyclone body 11. The receptacle 13 communicates with the cyclone body 11 exclusively 10 through the contaminant outlet 11c, and has an open bottom 13a which can be opened and closed by a base member 15 mounted on the lower end of the receptacle 13 so that collected contaminants can be removed from the receptacle 13. The base member 15 is spaced apart from the bottom 11b of the cyclone body 11 by a predetermined distance. Accordingly, a predetermined space is defined between the base member 15 and the cyclone body 11. One 15 end of the base member 15 is pivotally mounted on the lower portion of the contaminant receptacle 13 by a hinge shaft 14 to allow contaminant removal. For this purpose, a locking device 18 is also provided to lock or unlock the unhinged edge of the base member 15 to permit the base member 15 to selectively cover or uncover the bottom 13a of the contaminant receptacle 13.

20 The locking device 18 includes a pivot member 21 having a hook 21a for contacting and supporting the unhinged edge of the base member 15, and a spring 23. The pivot member 21 is pivotally mounted on an outer side of the contaminant receptacle 13 and resiliently biased by the spring 23 in a manner such that the hook 21a of the pivot member 21 is positioned at the bottom 13a of the contaminant receptacle 13. Further, the spring 23 25 is disposed between the contaminant receptacle 13 and the pivot member 21 to bias the other end of the pivot member 21. Accordingly, as indicated by the phantom lines in Figure 3, the base member 15 is locked in the hook 21a so as to cover the bottom 13a of the contaminant receptacle 13.

The cover 17 is connected to and covers the top 11a of the cyclone body 11 and 30 includes an air inlet passage 17a, an air outlet passage 17b, and a contaminant separating grille 17c, all of which communicate with the cyclone body 11. The air inlet passage 17a guides air, drawn in through the suction head 5, the connecting tube 2 and the connecting hose 3, into the cyclone body 11. The air inlet passage 17a extends tangentially towards the

interior of the cyclone body 11 to generate a vortex with the air drawn into the cyclone body 11. After the air and the contaminants are drawn through the air inlet passage 17a and the contaminants are separated from the air by centrifugation, and clean air is discharged through the air outlet passage 17b. The air outlet passage 17b is formed in the middle 5 portion of the cover 17. The contaminant separating grille 17c extends downwardly from the air outlet passage 17b a predetermined depth into the cyclone body 11, and has a plurality of fine holes for preventing the discharge of dust or contaminants.

As a preferred feature, a filtering section 19 is provided to filter the air which blows through the air outlet passage 17b toward the motor chamber 1b. The filtering section 19 10 includes an air filter 31, a filter case 33, and an air duct 35. The filter case 33, which houses the air filter 31, includes an air inlet 33a and an air outlet 33b. The air discharged from the air outlet passage 17b of the cyclone body 11 flows through the air inlet 33a, which is formed in the upper portion of the filter case 33. The air filter 31 is removably inserted into the filter case 33 through the air inlet passage 33a. The air outlet passage 33b is formed on 15 the side of the filter case 33 that faces the motor driving chamber 1b, when the filter case 33 is mounted in the dust collecting chamber 1a. The air duct 35 connects the air outlet passage 17b with the air inlet 33a of the filter case 33. As shown in Figure 1, the air duct 35 is formed in the cover 8 for the dust collecting chamber 1a. Accordingly, by closing or opening the cover 8, the air duct 35 can be respectively connected to or disconnected from 20 the air outlet passage 17b and the air inlet 33a.

The operation of the dust collecting apparatus will now be described.

Firstly, when the vacuum cleaner is on, the motor generates a strong suction force at the suction head 5. This suction force draws in air and contaminants on the cleaning surface through the suction head 5, connecting tube 2 and connecting hose 3, and into the 25 cyclone body 11. Air is drawn obliquely into the cyclone body 11 by the rotationally directing air inlet passage 17a and descends into the cyclone body 11 while creating a vortex. Accordingly, the contaminants are separated from the air by the centrifugal force of the vortex, descend along the interior of the cyclone body 11, and are discharged to the contaminant receptacle 13 through the contaminant outlet 11c. Here, since the contaminants 30 discharged into the contaminant receptacle 13 accumulate below the lower portion of the cyclone body 11, the reverse flow of contaminants into the cyclone body 11 through the contaminant outlet 11c, formed in the upper portion of the contaminant receptacle 13 is prevented.

Meanwhile, after the contaminants have been separated from the air, the clean air is discharged through the fine holes of the grille 17c and the air outlet passage 17b, and is drawn into the filter case 33 through the air duct 35. The air is then filtered as it passes through the air filter 31. Accordingly, even minute contaminants, which cannot be separated by the centrifugation, are captured by the air filter 31. The filtered air is then discharged to the environment after passing through the motor driving chamber 1b.

When the contaminant receptacle 13 is filled with contaminants, the user opens the cover 8 on the cleaner body 1. The air duct 35, which is formed in the cover 8, separates from the air outlet passage 17b of the cover 17 and the filter case 33. In this detached state, the user can access the cyclone device 7 in the dust collecting chamber 1a. By pressing the end of the pivot lever 21, the hook 21a disengages from the end of the base member 15 and, as shown in Figure 3, the base member 15 is free to open, exposing the bottom 13a of the contaminant receptacle 13. With the bottom 13a of the contaminant receptacle 13 open, the contaminants that have accumulated in the contaminant receptacle 13 can be removed. After dumping out the contaminants, the contaminant receptacle 13 can be closed by pushing the base member 15 up to the bottom of the 13a of the contaminant receptacle 13. The base member 15 is held in place by re-locking the hook 21a.

The air filter 31 can also be replaced by removing the old air filter and inserting a new one through the open air inlet 33a of the filter case 33.

Although the preferred embodiment of the present invention depicts a canister type vacuum cleaner (see Figure 1), it will be clearly understood that the cyclone type dust collecting apparatus of the invention also can be employed in other types of vacuum cleaners, such as the upright type vacuum cleaners or the like.

As explained above, since, in the described cyclone type dust collecting apparatus the contaminant receptacle is located below the lower portion of the cyclone body 11, the contaminants that have been discharged into the contaminant receptacle 13 cannot flow back into the cyclone body 11.

In addition, the apparatus improves the cleaning efficiency of the vacuum cleaner by providing a two-step contaminant separation process. The contaminants are first separated from the air by centrifugation in the cyclone body 11. After that, minute contaminants, which were not separated during the centrifugation process, are captured by the filtering section 19.

## CLAIMS

1. A vacuum cleaner comprising:

a cleaner body having a motor driving chamber and a dust collecting chamber in communication with the motor driving chamber;

5 a suction brush through which contaminants and air are drawn in; and

cyclone type dust collecting means mounted in the dust collecting chamber for separating the contaminants from the air by a centrifugation, the cyclone type dust collecting means comprising:

10 a hollow cylindrical cyclone body having an open top, a closed bottom, and a contaminant outlet, the open top allowing air and contaminants into the cyclone body, the cyclone body separating contaminants from the air by centrifugation, the contaminant outlet allowing the contaminants that have been separated from the air by centrifugation to pass through;

15 a contaminant receptacle covering the bottom and a portion of an outer surface of the cyclone body, the contaminant receptacle collecting the contaminants discharged through the contaminant outlet;

a base member pivotally coupled to the bottom of the contaminant receptacle; and

20 a cover for covering the top of the cyclone body, the cover having an air inlet passage through which air and contaminants drawn in through the suction brush enter into the cyclone body, an air outlet passage through which the air is discharged from the cyclone body, and a contaminant separating grille, the grille extending downward from the air outlet passage and having a plurality of fine holes.

2. A vacuum cleaner according to claim 1, further comprising filtering means for filtering the air which is discharged through the air outlet.

25 3. A vacuum cleaner according to claim 2, wherein the filtering means comprises:

an air filter;

a filter case housing the air filter, the filter case having an air inlet and an air outlet, the air outlet communicating with the motor driving chamber, the filter case being mounted in the dust collecting chamber; and

30 an air duct for connecting the air outlet passage to the air inlet of the filter case.

4. A vacuum cleaner according to claim 3, wherein the air duct is formed in a door of the vacuum cleaner, the door being hingedly connected to the cleaner body to open or close the dust collecting chamber, wherein the air duct is disconnected from or connected to the air outlet passage and air inlet when the door is opened or closed, respectively.

5 5. A vacuum cleaner according to any preceding claim, wherein one end of the base member is hingedly connected on a lower end of the contaminant receptacle, and the other end of the base member is connected to the contaminant receptacle by a locking means, whereby the bottom of the contaminant receptacle is closed or opened by respectively locking or unlocking the base member.

10 6. A vacuum cleaner according to claim 5, wherein the locking means comprises:  
a pivot member pivotally formed on an outer side of the contaminant receptacle, the pivot member having a hook formed on one end for preventing free fall of the end of the base member; and  
a spring for biasing the pivot member in a manner such that the hook supports the  
15 base member.

7. A vacuum cleaner including a cyclonic dust collector which comprises:  
a hollow cyclone body with a generally cylindrical outer wall, upper and lower end walls, an air inlet port associated with the upper end wall and shaped to promote rotational flow of air in the cyclone body, an axially located clean air exhaust port, and a  
20 circumferentially located contaminant outlet associated with the lower end wall; and  
a contaminant hopper extending across and covering the lower end of the cyclone body, the interior of the hopper communicating with the interior of the cyclone body via the contaminant outlet and being defined by the lower end wall of the cyclone body and a base wall in registry with and underlying the said lower end wall.

25 8. A cleaner according to claim 8, wherein the contaminant outlet is an opening in the cylindrical wall of the cyclone chamber adjacent the lower end wall.

9. A cleaner according to claim 7 or claim 8, wherein the contaminant hopper encloses a lower portion of the cyclone body cylindrical wall and the base wall comprises an openable cover for the hopper.
10. A cleaner according to any of claims 7 to 9, further comprising a secondary filtration device coupled to the clean air exhaust port.
11. A cleaner according to claim 10, having an access cover located over the cyclone body, and wherein the cover defining an air passage connecting the cyclone body exhaust port to the secondary filtration device.
12. A vacuum cleaner constructed and arranged substantially as herein described and shown in the drawings.

**Amendments to the claims have been filed as follows****1. A vacuum cleaner comprising:**

a cleaner body having a motor driving chamber and a dust collecting chamber in communication with the motor driving chamber;

a suction brush through which contaminants and air are drawn in; and cyclone type dust collecting means mounted in the dust collecting chamber for separating the contaminants from the air by a centrifugation, the cyclone type dust collecting means comprising:

a hollow cylindrical cyclone body having a cylindrical outer surface, an open top, a closed bottom, and a contaminant outlet, the open top allowing air and contaminants into the cyclone body, the cyclone body separating contaminants from the air by centrifugation, the contaminant outlet allowing the contaminants that have been separated from the air by centrifugation to pass through;

a contaminant receptacle covering the bottom and a portion of the cylindrical outer surface of the cyclone body, the contaminant receptacle collecting the contaminants discharged through the contaminant outlet;

a base member pivotally coupled to the bottom of the contaminant receptacle; and a cover for covering the top of the cyclone body, the cover having an air inlet passage through which air and contaminants drawn in through the suction brush enter into the cyclone body, an air outlet passage through which the air is discharged from the cyclone body, and a contaminant separating grille, the grille extending downward from the air outlet passage and having a plurality of fine holes.

**2. A vacuum cleaner according to claim 1, further comprising filtering means for filtering the air which is discharged through the air outlet.****3. A vacuum cleaner according to claim 2, wherein the filtering means comprises:**

an air filter;

a filter case housing the air filter, the filter case having an air inlet and an air outlet, the air outlet communicating with the motor driving chamber, the filter case being mounted in the dust collecting chamber; and

an air duct for connecting the air outlet passage to the air inlet of the filter case.

4. A vacuum cleaner according to claim 3, wherein the air duct is formed in a door of the vacuum cleaner, the door being hingedly connected to the cleaner body to open or close the dust collecting chamber, wherein the air duct is disconnected from or connected to the air outlet passage and air inlet when the door is opened or closed, respectively.

5. A vacuum cleaner according to any preceding claim, wherein one end of the base member is hingedly connected on a lower end of the contaminant receptacle, and the other end of the base member is connected to the contaminant receptacle by a locking means, whereby the bottom of the contaminant receptacle is closed or opened by respectively locking or unlocking the base member.

6. A vacuum cleaner according to claim 5, wherein the locking means comprises:  
a pivot member pivotally formed on an outer side of the contaminant receptacle, the pivot member having a hook formed on one end for preventing free fall of the end of the base member; and  
a spring for biasing the pivot member in a manner such that the hook supports the base member.

7. A vacuum cleaner including a cyclonic dust collector which comprises:  
a hollow cyclone body with a generally cylindrical outer wall, upper and lower end walls, an air inlet port associated with the upper end wall and shaped to promote rotational flow of air in the cyclone body, an axially located clean air exhaust port, and a contaminant outlet circumferentially located in the said outer wall and associated with the lower end wall; and  
a contaminant hopper extending across and covering the lower end of the cyclone body and a portion of the said outer wall of the cyclone body, the interior of the hopper communicating with the interior of the cyclone body via the contaminant outlet and being defined by the lower end wall of the cyclone body and a base wall in registry with and underlying the said lower end wall.

8. A cleaner according to claim 7, wherein the contaminant outlet is an opening in the cylindrical wall of the cyclone chamber adjacent the lower end wall.

9. A cleaner according to claim 7 or claim 8, wherein the base wall comprises an openable cover for the hopper.
10. A cleaner according to any of claims 7 to 9, further comprising a secondary filtration device coupled to the clean air exhaust port.
11. A cleaner according to claim 10, having an access cover located over the cyclone body, and wherein the cover defining an air passage connecting the cyclone body exhaust port to the secondary filtration device.
12. A vacuum cleaner constructed and arranged substantially as herein described and shown in the drawings.



Application No: GB 0025497.9  
Claims searched: 1-12

Examiner: Michael Young  
Date of search: 1 February 2001

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): A4F; B2P (P3X)

Int Cl (Ed.7): A47L 9/16; B04C 3/00; 5/185; 5/187

Other: ONLINE: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	US 6090174 (DOUMA) col.4 lines 45-50, fig.1 esp features 11, 17 & 45.	7
X	US 5294218 (FIORENTINI) col.2, lines 62-67, fig.1 esp feature 19	7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.